

TWO-DIMENSIONAL PHASE UNWRAPPING OF SAR INTERFEROGRAMS BY CHARGE CONNECTION THROUGH NEUTRAL TREES

Paul A. Rosen and Atsushi Hiramatsu*

Mail Stop 300-235, Jet Propulsion Laboratory, California Institute of Technology

4800 Oak Grove Drive, Pasadena, CA 91109 USA

TEL: USA (818) 354-0023, FAX: USA (818) 393-5285

*presently with NTT, Japan

Charles L. Werner

Remote Sensing Laboratories, Department of Geography

University of Zürich - Irchel, Winterthurerstrasse 190

CH-8057 Zürich, Switzerland

A new algorithm for two-dimensional phase unwrapping is presented. The method is similar to that of Goldstein et al (1988) in that it attempts to connect phase inconsistencies known as residues to generate neutral trees around which the phase field is consistent. In the Goldstein et al algorithm, residues are connected as they are encountered and the net charge of a tree can grow and shrink arbitrarily until the tree is finally neutralized. The new algorithm is different because all trees in the phase field are neutral at all times, i.e. a residue is not added to a tree unless an oppositely charged residue mate is added as well. New residues encountered are either neutralized directly with nearby oppositely charged residues, or with connections to opposite charges through pre-existing neutral trees. The tree structures in the two approaches are quite different. The Goldstein et al trees can be said to be quite conservative: regions dense with residues tend to have a dense web of trees through which the phase cannot be unwrapped. The neutral trees algorithm on the other hand produces very sparse trees, and phase unwrapping can be attempted in even the noisiest areas. In the synthetic aperture radar applications to which we have applied this method, a mask must be used to limit the unwrapping to regions of good interferometric correlation. This new algorithm with the added mask computation step generally affords greater flexibility and unwraps a larger portion of the phase field than other methods.